

Re-tuning Case Study

JBG Re-tunes Building and Upgrades Pneumatic Controls to DDC. Bethesda, MD

Re-tuning keeps energy use flat while occupancy and usage increases.



Address: 7200 Wisconsin Ave, Bethesda, MD
 Owner: The JBG Companies
 Size: 275,000 Square Feet

The mission of the JBG Companies is to be a world-class investor, owner, developer and manager of real estate properties in the Washington Metropolitan Area. JBG invests almost exclusively in urban-infill, transit-oriented developments, and holds a diverse portfolio that encompasses over 23.6 million square feet of office, residential, hotel and retail space.

In October of 2012, with training from experts at the Pacific Northwest National Laboratory (PNNL), JBG began re-tuning 7200 Wisconsin Avenue, an 11-story mixed-use building built in 1987. Not only is JBG implementing re-tuning measures, the company is also converting its pneumatics (manual) control system to direct-digital controls (DDC), adding two floors per year to its building automation system (BAS) platform. The building management saw the benefit of investing in the BAS, particularly with the added opportunities for re-tuning presented with BAS data. The BAS can automatically monitor the building's systems and identify areas for improved efficiency.

Building engineers incorporated a long list of specific re-tuning measures recommended by the PNNL trainers, with energy savings results showing a 1% reduction (as seen in Figure 1) from projected electricity usage.

While 1% does not seem significant, this was at the same time that the building occupancy went up, weekend HVAC use increased and only some of the floors were connected to the BAS in this first year post-re-tuning.

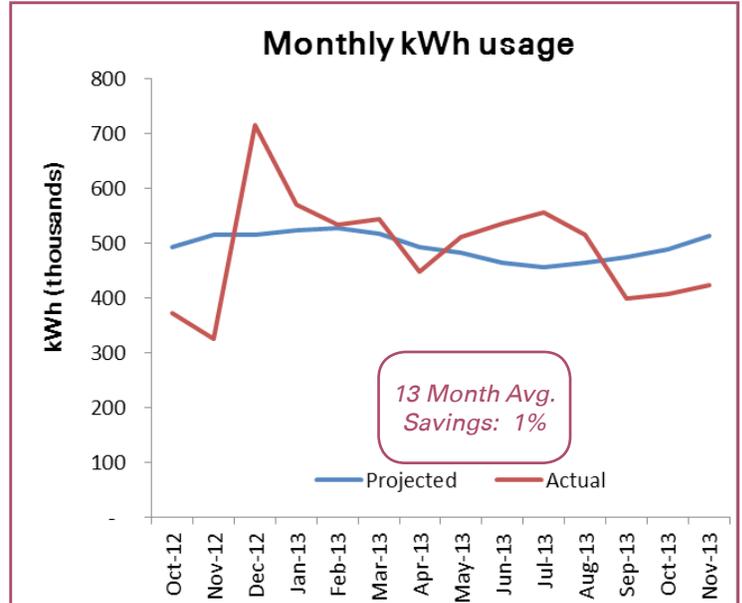


Figure 1. Projected kWh usage based on a year's monthly consumption prior to re-tuning and weather normalization.

What is Building Re-Tuning?

Building re-tuning is a systematic process to identify and correct building operational problems that lead to energy waste. Building Re-Tuning Training is a blend of building walk-throughs and classroom instruction that teaches building operations staff and service personnel how to save energy and increase occupant comfort through low and no-cost operational improvements. There are two versions of the training: one for small/medium sized buildings without a building automation system (BAS) and one for large buildings with BAS. This case study utilized the large building with BAS re-tuning protocol.

No- and low-cost savings opportunities include items such as replacing faulty sensors, adjusting set-points and inefficient schedules, utilizing variable speed fans and economizers, insulating pipes, adding CO2 sensors, widening thermostat dead bands, and sealing building envelope leaks. This process can reduce building energy use up to 20%.

Building re-tuning saves energy and money

From late 2013 to early 2015, PNNL helped identify re-tuning measures in 20 office buildings. Many of the measures were implemented by the building operations staff. The measurement and verification process is ongoing. Preliminary results indicate the savings are between 2% and 21% in buildings that implement at least a few measures. The average savings are 14% and the median savings are 12%.

Example: Re-tuning Opportunity Informed by Trending of BAS Terminal Zone Data

Figure 2 shows trended data from the BAS on zone 9 of the JBG Building’s Air Handling Unit (AHU) 11, in which one stage of electric reheat (red line, right axis) is always on to maintain the zone air temperature (green line, left axis) of roughly 71°F. The damper position (blue line, left axis) percent open pattern follows the zone air temperature data smoothly. This could indicate that the discharge-air temperature set point is too low for AHU-11. Also, the chilled water supply temperature may be too low, and the reheat at the zones can cause a “false” loading on the chiller. Re-tuning encourages data trending to identify efficiency opportunities such as this.

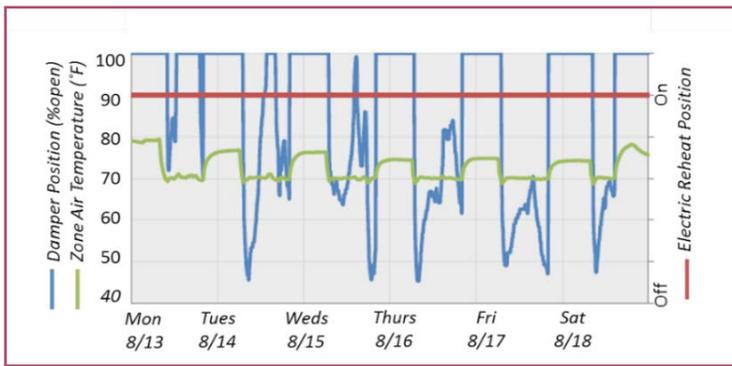


Figure 2. Trended Zone Temperature, Damper Position, & Electric Reheat command for Zone 9 on AHU-11

Opportunity: Reduce Excessive Energy Costs caused by Overuse of Electric Reheat

During the re-tuning activities, engineers conducted a spot check of the JBG building’s BAS Zones 1&2 and found discharge air temperatures in summer months of over 120-130°F. With supply air temperature shown at 71°F (green line in Figure 2), this indicates over-cooling and simultaneous electric reheat (constant electric reheat in zone 11 is shown in Figure 2). If this is widespread throughout the building, this could be a major energy cost to the building. Electrical prints noted that this building has electrical power feeders rated for over 1 MW of load, to serve VAV box reheat coils. Minimizing the reheat actions (summer or winter) will have huge impact on energy consumption and demand charges and should be investigated as a potentially significant opportunity.

Why Invest in Building Re-Tuning Training?

Building Re-Tuning Training is a worthwhile investment because saving energy is not reliant on commissioning agents, energy auditors or professional engineers. Facility engineers and building operators - the people who are in the buildings regularly – learn to identify energy saving opportunities and act. The savings are regenerative because the trained building operator or facility engineer is able to continuously re-tune his/her building and maintain optimized conditions.

Table 1. Re-tuning Recommendations for by JBG

System	Recommendation	Effort	Savings
Scheduling	Align schedules for all AHUs to match occupancy schedule	Low	High
Scheduling	Tighten up bathroom exhaust fan schedules to match AHU schedules	Low	High
Scheduling	Make sure garage exhaust fans are scheduled properly	Low	High
Scheduling	Reset discharge-static pressure set points by schedule to 1 inch set point (or less) around 3pm each day	Low	High
Scheduling	Reduce lighting schedules for hallways where possible	Low	High
Garage Exhaust Fans	Look at running 2 exhaust fans instead of 3, as non-running exhaust fan was spinning backwards indicating recirculation of air. Replace belts and adjust sheaves on fans with slipping belts.	Med	Med
Chiller System	Enable chiller isolation valve control so chiller isolation valve is closed when respective chiller is off, and open when running	Med	Med
Envelope	Replace garage insulation, repair expansion joints & seal piping penetrations	Med	Low
Envelope	Investigate mold issues on outside of building and make sure mold is not getting into outdoor-air intake and seal 11th floor windows (no infiltration)	Med	Low
Envelope	Roof standing water and garage water leaks should be evaluated and resolved as water can be problematic	Med	Low
Water-Side Economizer System	Investigate ability of “new plate and frame cooling” system’s ability to provide free cooling during the cooling season (from previous owner). If not needed, valve out the system or find another purpose for it.	High	High

Strategy for Success: Utilize Prescriptive Re-tuning Measures for Floors without BAS

In the 7200 Wisconsin Avenue building, only some of the floors include building systems controlled by a BAS. Many of the floors are still running with manual pneumatic controls. Some prescriptive re-tuning opportunities to look for while examining HVAC equipment include efficiencies such as:

- Missing or leaking panels/access doors
- Outdoor-air dampers wide open or fully closed
- Ensure pneumatic controls include proper air pressure (20-25 PSI) checks once every 3 months
- Poor maintenance
- Other conditions that might affect performance

Acknowledgements:

This case study and related work is funded by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. Pacific Northwest National Laboratories created the building re-tuning training program and performed the building re-tunings for this case study.

Re-tuning Training Opportunities and Online Resources

The Department of Energy funded Pacific Northwest National Labs (PNNL) to create the Building Re-Tuning Training program. The Consortium for Building Energy Innovation (CBEI) is leading efforts for DOE to make Building Re-Tuning Training available. See <https://www4.eere.energy.gov/workforce/projects/buildings-retuning-training> for information about accessing the training. Classroom training material, training instructor manual and online re-tuning interactive training and energy charting and metrics tools are available at <http://buildingretuning.pnnl.gov/>